

## Guidelines for Management of DKA

### Diagnosing DKA & Initial Workup

<b>Diagnostic Criteria</b>	<ul style="list-style-type: none"> <li>● pH <math>\leq</math> 7.30</li> <li>● +<math>\beta</math>-hydroxybutyrate (urine ketones come back faster, but <u>negative urine ketones do not rule out DKA</u>)</li> <li>● Anion Gap <math>&gt;</math> 12 (remember to use the <u>uncorrected Na<sup>+</sup></u> when calculating the AG)</li> <li>● Glucose <math>&gt;</math> 250 mg/dL (Note: in euglycemic DKA, hyperglycemia maybe absent or minimal. Consider this diagnosis if all other criteria are present in patients with diabetes, especially if they take SGLT-2 inhibitors)</li> </ul>
<b>Initial Workup</b>	<ul style="list-style-type: none"> <li>● BMP</li> <li>● Mg<sup>2+</sup></li> <li>● PO<sub>4</sub></li> <li>● Serum Acetone</li> <li>● Serum <math>\beta</math>-hydroxybutyrate</li> <li>● ABG</li> <li>● Serum Osm</li> <li>● CBC</li> <li>● UA</li> <li>● Uosm</li> <li>● hCG (in women of reproductive age)</li> </ul>
<b>Identify Precipitant</b>	<p>Common precipitants: insulin omission, infection, ischemia (including MI), and intra-abdominal processes.</p> <ul style="list-style-type: none"> <li>● LFTs</li> <li>● Lipase</li> <li>● Urinalysis</li> <li>● CXR</li> <li>● EKG</li> <li>● Blood Cultures</li> <li>● Troponins</li> </ul>

### DKA Management

Management goals include volume resuscitation, correction of the anion gap metabolic acidosis, correcting K<sup>+</sup> and Mg<sup>2+</sup> abnormalities and reducing glucose to 150-200 mg/dL.

<b>Insulin</b>	<ul style="list-style-type: none"> <li>● If K<sup>+</sup> <math>&lt;</math> 3.3 mEq/L, hold insulin until actively correcting K<sup>+</sup>.</li> <li>● Start <b>Insulin gtt 0.14 Units/kg/hr</b> <ul style="list-style-type: none"> <li>○ <b>Check FS every 1 hour</b></li> <li>○ <u>Initial Goal</u>: <math>\downarrow</math> Glucose by 50-75 mg/dL/hr</li> <li>○ <u>Target Glucose</u>: 150 – 200 mg/dL</li> <li>○ Follow Insulin gtt protocol:</li> </ul> </li> </ul> <table border="1" style="margin: 10px auto; width: 80%; border-collapse: collapse;"> <thead> <tr style="background-color: #a0c0ff;"> <th>Blood Glucose (mg/dL)</th> <th>Rate of Drop (mg/dL)</th> <th>New Drip Rate (Units/hr)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">&gt;200</td> <td style="text-align: center;">&lt;50</td> <td style="text-align: center;">Rate x2</td> </tr> <tr> <td style="text-align: center;">&gt;200</td> <td style="text-align: center;">50-75</td> <td style="text-align: center;">No change</td> </tr> <tr> <td style="text-align: center;">&gt;200</td> <td style="text-align: center;">&gt;75</td> <td style="text-align: center;">Rate x ½</td> </tr> <tr> <td style="text-align: center;">150-200</td> <td style="text-align: center;">NA</td> <td style="text-align: center;">Weight (kg) x0.02</td> </tr> <tr> <td style="text-align: center;">70-150</td> <td style="text-align: center;">NA</td> <td style="text-align: center;">If old rate <math>&gt;</math>3 Units/hr <math>\rightarrow</math> change to 1 Units/hr if old rate <math>&lt;</math>3 Units/hr <math>\rightarrow</math> change to 0.5 Units/hr</td> </tr> <tr> <td style="text-align: center;">&lt;70</td> <td style="text-align: center;">NA</td> <td style="text-align: center;">Initiate hypoglycemia protocol</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>● When <b>Glucose <math>&lt;</math> 250 mg/dL</b>, add D5 to IVF at 150 mL/hr and <math>\downarrow</math> insulin gtt to <math>\leq</math> 0.05 U/kg/hr. You may need to increase the insulin gtt to maintain glucose goals. <ul style="list-style-type: none"> <li>○ Glucose Goal = 150-200 mg/dL</li> <li>○ <u>Goal</u>: clear ketoacidosis and close anion gap using insulin while avoiding hypoglycemia</li> </ul> </li> </ul>	Blood Glucose (mg/dL)	Rate of Drop (mg/dL)	New Drip Rate (Units/hr)	>200	<50	Rate x2	>200	50-75	No change	>200	>75	Rate x ½	150-200	NA	Weight (kg) x0.02	70-150	NA	If old rate $>$ 3 Units/hr $\rightarrow$ change to 1 Units/hr if old rate $<$ 3 Units/hr $\rightarrow$ change to 0.5 Units/hr	<70	NA	Initiate hypoglycemia protocol
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K <sup>+</sup>	<ul style="list-style-type: none"> <li>● If initial K<sup>+</sup> &lt;3.3, replete K<sup>+</sup> immediately and hold insulin until actively correcting the K<sup>+</sup> to avoid dangerous hypokalemia.</li> <li>● Hold K<sup>+</sup> repletion in patients with <b>ESRD</b>, and be cautious in <b>CKD with urine output &lt;50 cc/hr</b>.</li> <li>● Replete K<sup>+</sup> per the guidelines below:</li> </ul>	
	K <sup>+</sup> >5	No K <sup>+</sup> repletion
	K <sup>+</sup> 4-5	Add <b>20 meq KCl /L</b> to IVF x2L OR give <b>40 mEq IV or PO K<sup>+</sup></b>
	K <sup>+</sup> 3.3 – 4	Add <b>20 meq KCl /L</b> to IVF x2L OR give <b>60 mEq IV or PO K<sup>+</sup></b>
	K <sup>+</sup> <3.3	Give <b>60-80 mEq K<sup>+</sup></b> as IV + PO. Check K <sup>+</sup> ever 1-2 hrs.
Other Electrolytes	Mg <sup>2+</sup> <1.5 mg/dL	Give <b>2g IV MgSO<sup>4</sup></b>
	PO <sub>4</sub> <1 mg/dL	Give <b>0.24 mmol/kg Potassium Phosphate</b> in <b>250 cc fluid</b> over 6 hrs
	HCO <sup>3-</sup>	Consider administering HCO <sup>3-</sup> ONLY if pH <7.0

### Lab Monitoring

- Check **FSG** every **1 hr**
- **At least 2 hrs after initial treatment**, re-check a **BMP** and **VBG** to check **K+** and **pH**
- Check **BMP, Mg<sup>2+</sup>** and **PO<sub>4</sub>** every **4 hrs** until the anion gap closes and electrolytes normalize

### Conversion to Subcutaneous Insulin

- Convert to subcutaneous insulin when the following criteria are met:
  - **Anion Gap <12**
  - **HCO<sub>3</sub> >15 mEq/L** or **pH >7.30**
  - **Glucose <200 mg/dL**
  - patient is clinically stable and **ready to eat**.
- **STOP the insulin gtt 2 HOURS after administering subcutaneous basal insulin.**
- **NOTE:** For the purposes of nursing, it is easier to start long-acting insulin (glargine, detemir) if it's ordered Qam or Qhs. If transitioning a patient off an insulin gtt at another time of day, you can use NPH as a bridge, or the gtt can be extended a few hours until a convenient time.

New-Onset Diabetes	<b>Weight-Based Dosing</b> <ul style="list-style-type: none"> <li>○ <b>Total daily insulin dose</b> should be <b>~0.5 Units/kg/day</b>, divided as follows: <ul style="list-style-type: none"> <li>▪ <b>Basal Insulin:</b> Give <b>0.25 Units/kg</b> as <b>basal insulin</b></li> <li>▪ <b>Mealtime Insulin:</b> Give <b>0.25 Units/kg/day ÷ 3</b> for each meal</li> </ul> </li> <li>○ Assess the patient's response to the mealtime insulin after their first meal, and adjust mealtime insulin as needed.</li> </ul>
	<b>Insulin-Drip Based Dosing</b> (CAUTION: this method may <i>overestimate</i> the patient's insulin needs) <ul style="list-style-type: none"> <li>○ <b>Total insulin given over prior 6 hours x4 = Total IV units/day</b></li> <li>○ Total IV units/day x0.70 = <b>Total Subcutaneous Insulin</b></li> <li>○ <b>Basal Insulin:</b> Total Subcutaneous Insulin ÷ 2</li> <li>○ <b>Mealtime Insulin:</b> Total Subcutaneous Insulin ÷ 6</li> <li>○ Assess the patient's response to the mealtime insulin after their first meal, and adjust mealtime insulin as needed.</li> </ul>
Prior Diabetes Diagnosis	<ul style="list-style-type: none"> <li>○ Start insulin as above <u>or</u> restart home basal and mealtime insulin if the patient was adherent, controlled, and without major hypoglycemic episodes.</li> </ul>

### Diet Orders

Make sure the patient is on a **consistent carb diet** with the modification, **"no concentrated sweets"**

### Discharge Considerations

- All patients starting new home insulin should receive **insulin teaching** and **glucometer teaching**
- Discharge patients with appropriate **diabetic supplies**
  - 5 glargine (Lantus or Basaglar) pens
  - 5 lispro/aspart (Novolog or Humalog) pens
  - 100 pen needle tips + 1 refill
  - Blood glucose meter (pharmacist's choice)
  - 150 Blood glucose test strips (pharmacist's choice) with 3 refills (if checking glucose 4-5x/day) + 3 refills
  - 150 lancets + 3 refills
  - 200 alcohol swabs + 3 refills

### **Additional Resources**

- Call **Endocrine/Diabetes consult (x6141)** with any **questions** and for patients with **ESRD** or **Type I Diabetes**
- Contact **Clinical Pharmacists** for teaching for patients with new-onset diabetes, assessing which medications/supplies are covered by insurance, etc.